EMBEDDED SYSTEM **Course Code : 315338**

Programme Name/s	**: Automation and Robotics/ Digital Electronics/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electronics & Communication Engg./ Electronics Engineering/ Industrial Electronics/ Electronics & Computer Engg./**
Programme Code	**: AO/ DE/ EJ/ EK/ ET/ EX/ IE/ TE**
Semester	**: Fifth**
Course Title	**: EMBEDDED SYSTEM**
Course Code	**: 315338**

I. RATIONALE

Embedded systems are designed for specific tasks to excel in real-time performance, resource utilization and reliability. These systems are playing vital role in modern technology, enabling sophisticated functionalities in a wide array of devices and applications. Embedded systems are integral to the advancement of technology across multiple sectors. By learning this course, students will develop skills to use embedded system for simple applications. It will also enable them to use open-source embedded system for solving real time problems.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help students to attain the following industry/employer expected outcome through various teaching learning experiences:
"Develop simple applications based on embedded system."

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Select the relevant microcontrollers for various industrial applications.
- CO2 - Choose appropriate family of microcontroller for different applications.
- CO3 - Interpret the communication standards of embedded systems.
- CO4 - Analyze the features of Real Time Operating System.
- CO5 - Develop the basic applications using Arduino.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315338	EMBEDDED SYSTEM	ESY	DSC	5	-	2	2	9	3	3	30	70	100	40	25	10	25#	10	25	10	175

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Identify the components of the embedded system and their functions. TLO 1.2 Describe the given characteristic of the specified embedded system. TLO 1.3 Classify the embedded system. TLO 1.4 List the selection factors of the embedded systems.	**Unit - I Overview of Embedded Systems** 1.1 Embedded system, block diagram description, layered model 1.2 Characteristics of embedded system: CPU type, maximum CPU speed, processing power, memory, performance 1.3 Classification of embedded system: small scale, medium scale, sophisticated, stand-alone, reactive/real time (soft and hard real time) 1.4 Selection criteria of embedded system: operating system, reliability, NRE cost, unit cost, size, flexibility, time to prototype, time to market, maintainability, correctness and safety	Lecture using Chalk-Board Presentations
2	TLO 2.1 Compare different types of micro controllers used for embedded system designing. TLO 2.2 Describe AVR microcontroller with the help of block diagram. TLO 2.3 Sketch the block diagram of ATmega 8 and describe the functions of each block. TLO 2.4 Compare specifications of microcontrollers ATmega 8 and ATmega 328. TLO 2.5 List the features of Arduino specific microcontrollers.	**Unit - II Microcontroller Architecture** 2.1 Microcontroller Types: PIC, AVR, ARM, features and applications 2.2 AVR microcontroller: types , architecture 2.3 ATmega 8: features, internal architecture 2.4 Programming configurations of ATmega 8: I/O port, peripherals counter, timer 2.5 Comparison of ATmega 8 and ATmega 328 2.6 Features of Arduino specific AVR microcontroller ATmega 168/328	Presentations Lecture using Chalk-Board Site/Industry Visit

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Describe the given type of modes for communication. TLO 3.2 Describe the given communication protocol(s) with relevant sketches. TLO 3.3 Describe the given wireless serial communication interface. TLO 3.4 Differentiate between given protocols for given parameters.	**Unit - III Communication Standards and Protocols** 3.1 Modes of communication: serial, parallel, synchronous and asynchronous 3.2 Communication Protocols its types: Serial: I2C, CAN, USB 3.3 Serial peripheral interface (SPI), IEC 61850 GOOSE (Protocol for Electric power system applications) 3.4 Wireless protocol : IrDA, Bluetooth, Zigbee, WiFi, LORA, LoWPAN	Lecture using Chalk-Board Presentations
4	TLO 4.1 Describe the functions of the given operating system. TLO 4.2 Compare RTOS and general OS for the given parameters. TLO 4.3 Describe features of RTOS with neat sketch. TLO 4.4 Explain deadlock condition in RTOS with suitable sketch.	**Unit - IV Real Time Operating System** 4.1 Operating system: general and real time operating system 4.2 Characteristics of real time operating system: consistency, reliability, scalability, performance, predictability 4.3 Functions of RTOS, Task management: inter task communication and multitasking, Scheduling: scheduling algorithms, resource allocation and interrupt handling 4.4 Features of RTOS: watchdog timer, semaphore 4.5 Deadlock: reasons of occurrence, handling of deadlock	Lecture using Chalk-Board Flipped Classroom Presentations
5	TLO 5.1 Enlist the different types of Arduino boards and their major features. TLO 5.2 Describe the working of development board using block diagram. TLO 5.3 Describe the given Arduino functions. TLO 5.4 Write steps to interface the given peripheral with Arduino. TLO 5.5 Interface the given sensor with Arduino.	**Unit - V I/O Interfacing with Arduino** 5.1 Arduino Board: introduction, types: Arduino UNO, NANO, MEGA 5.2 Functional Block Diagram of Arduino, pin functions of Arduino 5.3 Functions used in Arduino: math, analog I/O, digital I/O, timer 5.4 Peripheral interfacing with Arduino: keyboard, LCD, seven segment LED, relay, stepper motor, DC motor 5.5 Sensor interfacing with Arduino: temperature sensor, ultrasonic sensor	Lecture using Chalk-Board Presentations

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Identify pins and functions of AVR and PIC microcontroller.	1	*Identification of pins of AVR and PIC Microrontroller	2	CO1 CO2
LLO 2.1 Use an Integrated Development Environment (IDE) tool for developing C Programs of ATmega 168/328.	2	Use an IDE for ATmega 168/328 programming	2	CO2
LLO 3.1 Develop AVR C program to perform addition, subtraction, and multiplication operations on two constant data and output the result to port with some delay between each output.	3	*Write C program to perform various arithematic operations	2	CO2
LLO 4.1 Interface 4 x 4 LED matrix with AVR. LLO 4.2 Develop C program to display various patterns.	4	*Interface LED matrix with AVR microcontroller	2	CO2

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 5.1 Configure USB protocol on PC .	5	Serial Communication using USB	2	CO3
LLO 6.1 Install Arduino IDE and its development tool for Windows/MacOS/Linux operating systems.	6	*Installation of Arduino IDE for Windows/MacOS/Linux operating Systems	2	CO5
LLO 7.1 Build the circuit using 4 switches and 4 LEDs to Arduino Board. LLO 7.2 Test the LED on/off as per switch positions.	7	Building and Testing switch and LED interface using Arduino	2	CO5
LLO 8.1 Develop programs to perform arithmetic operation using math functions: constrain (), max (), min (), Pow(), sq(), sqrt() uisng Arduino.	8	*Programs to perfrom arithematic operations on Arduino	2	CO5
LLO 9.1 Interface two 16 x 2 LCD modules with Arduino using I2C serial communication protocol.	9	*LCD Interfacing to Arduino board	2	CO5
LLO 10.1 Develop program to read the data from the temperature sensor through Arduino and display on LCD.	10	Temperature sensor interfacing to Arduino board	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Assignment

- List different types of sensors and actuators used with embedded system and also write application of each sensor
- Create a program to control a DC motor using PWM (Pulse Width Modulation).
- Interface a temperature sensor with Arduino and display the readings on the serial monitor
- Develop a simple program to blink an LED using assembly language.
- Implement SPI communication to control an LED matrix display.
- Conduct a market survey for various types of Arduino boards available

Micro project

- Control the position of a servo motor using Arduino
- Control home appliances using Arduino and relays
- Design digital soil moisture meter using Arduino
- Implement a digital clock using an RTC (Real-Time Clock) module
- Create a digital thermometer using arduino and a temperature sensor
- Implement an RFID-based door lock system using Arduino
- Create a simple home automation system to control appliances using an AVR/PIC microcontroller
- Measure distances using an ultrasonic sensor and display the results on an LCD
- Interface any I/O deice to Raspberry pi development board

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Components: AVR, PIC Microcontroller	1
2	PIC Microcontroller: 32.768 KHz and 20 MHz Crystal, On-Board Debugger, USB Powered or externally powered, Adjustable target voltage	1
3	Temperature sensors; range -55 to 125°C	10
4	Simulation softwares: Arduino IDE, Atmel studio, Microchip studio.	3,4,7,8,9,10
5	Microcontroller kit (AVR ATmega 168/328 board and PIC): single board systems with minimum 8K RAM, ROM memory with battery backup, 16 x 4 LCD display, seven segment display, PC keyboard interfacing facility, cross 'C' compiler, USB, interfacing facility with built in power supply.	4
6	Arduino board UNO/ Nano or available microcontroller: ATmega328P, operating voltage: 5V input voltage (recommended): 7-12V input voltage (limit): 6-20V digital I/O pins: 14 (of which 6 provide PWM output) analog input pins: 6 DC current per I/O Pin: 20 mA DC current for 3.3V pin: 50 mA flash memory: 32 KB (ATmega328P) of which 0.5 KB used by bootloader SRAM: 2 KB (ATmega328P) EEPROM: 1 KB (ATmega328P) clock speed: 16 MHz LED bulit in: 13 dimensions: 68.6 mm x 53.4 mm weight: 25 g	6,7,8,9
7	LCD 16x2 Modules	9
8	Desktop PC with mininum RAM 4GB, Windows OS	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Overview of Embedded Systems	CO1	8	4	4	4	12
2	II	Microcontroller Architecture	CO2	12	2	6	8	16
3	III	Communication Standards and Protocols	CO3	8	2	4	8	14
4	IV	Real Time Operating System	CO4	10	4	6	2	12
5	V	I/O Interfacing with Arduino	CO5	12	2	6	8	16
Grand Total				**50**	**14**	**26**	**30**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two offline unit tests of 30 marks and average of two unit test marks will be consider for out of 30 marks.

•For formative assessment of laboratory learning 25 marks.
•Each practical will be assessed considering 60% weightage to process, 40% weightage to product.

EMBEDDED SYSTEM **Course Code : 315338**

Summative Assessment (Assessment of Learning)

- End semester assessment is of 70 marks.
- End semester summative assessment is of 25 marks for laboratory learning.

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	2	1	1	-	2			
CO2	3	3	2	2	1	1	2			
CO3	2	2	2	2	1	-	2			
CO4	2	1	2	2	1	1	2			
CO5	3	3	2	3	1	1	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Raj Kamal	Microcontroller Architecture Programming, Interfacing and System Design	Pearson Education India, Delhi, 2012 ISBN: 978-8131759905
2	Muhamed Ali Mazidi, Sarmad Naimi, Sepehr Naimi	AVR Microcontroller and Embedded Systems: Using Assembly and C	Pearson Education India, Delhi, 2013 ISBN: 978-9332518407
3	Dawoud Shenouda Dawoud, Peter Dawoud	Serial Communication Protocols and Standards	River Publishers, Denmark, 2020 ISBN: 978-8770221542
4	David E. Simon	An Embedded Software Primer	Addison-Wesley, Delhi, 2002 ISBN: 978-9332518407
5	J.M.Hughes	Arduino: A Technical Reference	O'REILLY, 2016 ISBN: 978-1491921760
6	Jeremy Blum	Exploring Arduino Tools and Techniques for Engineering Wizardry	John Wiley & Sons, 2019 ISBN: 978-1118549360
7	Michael McRoberts	Beginning Arduino	APRESS, 2011 ISBN: 978-1430232414
8	K. V. K. K. Prasad	Embedded Real –Time Systems concepts, Design & Programming Black Book	Dreamtech Press New Delhi, 2003 ISBN: 978-8177224610
9	Frank Vahid, Tony Givargis	Embedded System Design A Unified Hardware/ Software Introduction	Wiley India, New Delhi,2006 ISBN: 978-0471386780

XIII . LEARNING WEBSITES & PORTALS

EMBEDDED SYSTEM **Course Code : 315338**

Sr.No	Link / Portal	Description
1	https://www.microchip.com/en-us/tools-resources/develop/microchip-studio	Microchip Studio for AVR® and SAM Devices is an integrated development platform from Microchip
2	http://arduino.cc/	Link for Arduino Related Hardware and Software Download and installation
3	https://learn.sparkfun.com/tutorials/what-is-an-arduino	Arduino Basics
4	https://onlinecourses.swayam2.ac.in/aic20_sp04/preview	Introduction and Concepts of Arduino
5	https://support.arduino.cc/	Tutorials, data sheets, guides and other technical documentation
6	http://vlabs.iitkgp.ac.in/rtes/	Virtual lab link for Microcontrollers
7	https://semiconductors.es/datasheet-pdf/219613/ATMEGA32.html	Datasheet for ATmega Microcontrollers
8	https://www.alldatasheet.com/datasheet-pdf/pdf/82338/MICROCHIP/PIC16F877A.html	Datasheet for PIC Microcontroller

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s	**: Automobile Engineering./ Artificial Intelligence/ Artificial Intelligence and Mach Automation and Robotics/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Compute Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Comp Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-comm Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Co Electronics Engineering/ Computer Hardware & Maintenance/ Industrial Electronics/ Information Technol Information Technology/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Produ Computer Science/ Electronics & Computer Engg.**
Programme Code	**: AE/ AI/ AN/ AO/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IE/ IF/ IH/ LE/ ME/ MK/ PG/ SE/ TE**
Semester	**: Fifth**
Course Title	**: SEMINAR AND PROJECT INITIATION COURSE**
Course Code	**: 315003**

I. RATIONALE

Most of the diploma graduates lack the confidence and fluency while presenting papers or interacting verbally an with a large gathering. Seminar presentation boosts the confidence of the students and prepares them precisely interviews and group discussions. The course on seminar is to enhance student's ability in the art of academic wri also helps broaden the minds of the participants. Through this course on Seminar, students will develop new ideas subject /themes of emerging technologies and services of their area of studies. Project initiation enhances proje establishes measurable objectives and interaction skills.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various t experiences: Present a seminar on the selected theme/area of study effectively and confidently to the specific audien Plan innovative solutions independently or collaboratively to the identified problem statement.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify topics of seminar presenting to the large gathering at the institute/conference.
- CO2 - Collect relevant and updated research-based data and information to prepare a paper of seminar presenta
- CO3 - Apply presentation skills.
- CO4 - Create conducive environment for learning and discussion through seminar presentation.
- CO5 - Identify a problem statement and establish the action plan for the successful completion of the project.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment S						
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Base	
				CL	TL	LL					FA-TH	SA-TH	Total		FA-	
											Max	Max	Max	Min	Max	
315003	SEMINAR AND PROJECT INITIATION COURSE	SPI	AEC	-	-	1	2	3	1	-	-	-	-	-	25	

V. General guidelines for SEMINAR and Project Initiation

- The seminar must be related to emerging trends in engineering / technology programme or may be inter/ multi- industry expected outcomes of the programme.

- The individual students have different aptitudes and strengths. Therefore, SEMINAR should match the strengths purpose, students shall be asked to select the TITLE (Theme)of SEMINAR they would like to prepare and present
- Seminar titles are to be finalized in consultation with the faculty mentor.
- Seminar must involve logic development of applications of various technologies/ processes applicable in industr
- Seminar must be assigned to the single student. However, support of other students may be sorted while presen
- Students are required to prepare using relevant software tools, write ups for presentation
- Students shall submit One Hard copy and one Soft copy each of the presentation and may be encouraged to keep presentation made during the seminar.
- Batch of 3-4 students shall be formed for project initiation.
- Projects give a platform for the students to showcase an attitude of inquiry to identify the problem statement re Students shall Identify the information suggesting the cause of the problem and possible solutions
- Students shall study and assess the feasibility of different solutions and the financial implications.
- Students should collect relevant data from different sources (books/internet/market/suppliers/experts through s
- Students shall prepare required drawings/ designs and detailed plan for the successful execution of the work.
- Students may visit the organisation pertaining to the problem statement as part of initial study.

VI.Guidelines for Seminar preparation and presentation :

Once the title/topic of a seminar has been finalized and allotted to the student, the teacher's role is important as motivator, to promote learning and sustain the interest of the students.

Following should be kept in mind while preparing and presenting the seminar:

- **Seminar Orientation cum -briefing**: the seminar topics/themes should be innovative, novel and relevant to th programme, and also aligned to the expectations of industry.
- **Seminar Literature surve**y: Information search and data collection: the information and data should be authe to the curriculum of the programme.
- **Seminar Preparation, and presentation**: The seminar shall be present with suitable software tools and suppor presentation of seminar should not be more than 20 minutes including Q-A session.

The following guidelines may be followed for Project Initiation

- **Establishing project scope:** Determine the boundaries of the project.
- **Defining project objectives:** Set clear and measurable objectives that align with the project's purpose.
- **Stakeholder identification and analysis:** Perform an exercise in identifying all stakeholders involved in the pr needs and expectations.
- **Team Formation:** Carefully build a team with the necessary skills and expertise to execute the project successfu
- **Documentation.** Create a project planner showcasing the action plan, define the project's scope, outline the pro of the project. The document has to be made available to all stakeholders

VII. Criteria of Assessment /Evaluation of Seminar

A. Formative Assessment (FA) criteria

The assessment of the students in the fifth semester Progressive Assessment (PA) for 50 marks is to be done base

A. Suggestive RUBRICS for assessment

Sr. No.	Criteria
1	Selection Topic/Theme of seminar
2	Literature review and data presentation
3	Quality of Preparation and innovativeness
4	Q-A handling
5	Time Management
6	Seminar Presentation report

Rubrics for assessment of Project Initiation

Sr. No.	Criteria
1	Selection of Theme of Problem Statement and its innovativeness
2	Stages of development of Action plan
3	Prototyping

The total marks as per above out of 50, shall be converted in proportion of 25 marks.

B. Summative Assessment criteria/

The summative assessment of the students in the fifth semester End-Semester-Examination (ESE) for 50 marks is to be done based on following criteria. This assessment shall be done by the Faculty.

Suggestive **RUBRICS** may be developed by the faculty

Sr. No.	Criteria
1	Quality of information/Knowledge presented in SEMINAR
2	Creativity, Innovation in SEMINAR presentation
3	Response to the question during seminar presentation
4	Establishment of Innovative Problem Statement and its presentation
5	Objectives of the project and action plan

The total obtained marks shall be converted in proportion of 25 marks.

VIII. Suggestive CO-PO Mapping

Course Outcomes (COs)	**Programme Outcomes (POs)**						
	PO-1 Basic and Discipline Specific Knowledge	**PO-2** Problem Analysis	**PO-3** Design/ Development of Solutions	**PO-4** Engineering Tools	**PO-5** Engineering Practices for Society, Sustainability and Environment	**PO-6** Project Management	**P** L L
CO-1	3	1	0	-	2	2	
CO-2	2		2	-	2	1	
CO-3	3	1	1	2	1	2	
CO-4	2	0	0	2	1	2	
CO-5	3	3	3	2	2	3	

VIII.Typographical instructions/guidelines for seminar preparation & presentation

- The seminar PPT shall be computer typed (English- British)
- Text Font -Times New Roman (TNR), Size-12 point
- Subsection heading TNR- 12 point bold normal
- Section heading TNR- 12 capital bold
- Chapter Name/ Topic Name – TNR- 14 Capital
- All text should be justified. (Settings in the Paragraph)
- Different colors text/diagrams /tables may used
- The name of the candidate, diploma (department), year of submission,name of the institute shall be printed

IX.Seminar and Project Initiation Report

On completion and presentation of Seminar, every student will submit a brief report which should contain the f

- Cover Page (as per annexure 1)
- Title page (as per annexure 2)
- Certificate by the Guide (as per annexure 3)
- Acknowledgment (The candidate may thank all those who helped in the execution of the project).
- Abstract of Paper presented in the seminar (It should be in one page and include the purpose of the semina
- Index
- List of Figures
- Introduction
- Literature Review
- Information/Chapters related to Seminar topic
- Advantages and Disadvantages
- Conclusion
- Project Initiation : a) Description of problem statement. b) Scope and objectives. c) State holder d) Platform/ identification.
- Bibliography
- References

NOTE: Seminar report must contain only relevant – technology or platform or OS or tools used and shall not exc

Details of Softcopy to be submitted:
The soft copy of seminar presentation is required to be provided on the back cover of the seminar report in clea include the following folders and contents:

1.Presentation (should include a PPT about project in not more than 15 slides)
2.Documentation (should include a word file of the project report)

NOTE: Soft copy must be checked for any harmful viruses before submission.

X. Sample Formats

1) Cover Page - Annexure-I

2) Index - Annexure-II

3) Assessment - Annexure-III

Annexure - I

MSBTE LOGO

SEMINAR Report

“SEMINAR Title_ _ _ _ _ _ _ _ _ _ _ _ _”

as a partial fulfilment of requirement of the

THIRD YEAR DIPLOMA IN

Submitted by

Name of Student **Enrollment Number**

FOR THE ACADEMIC YEAR 20___20___

(H.O.D) **(Principal)**

(Internal Guide) **(External Examiner)**

Annexure - II

Institute Name

(An Affiliated Institute of Maharashtra State Board of Technical Education)

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***Students can add/remove/edit chapter names as per the discussion with their guide**

Annexure - III

Format for SEMINAR and PROJECT INITIATION Assessment /Evaluation

Formative Assessment

CRITERIA AND WEIGHTAGE

Enrollment No	**1** Selection Topic/Theme of seminar (5)	**2** Literature review and data presentation (5)	**3**. Quality of Preparation and innovativeness (5)	**4** Q-A handling (5)	**5** Time Management (5)	6. Seminar Presentation report (10)	7 Selection of Theme of Problem Statement and its innovativeness (5)	**8** Stages of developm of Action plan (5)

SummativeAssessment

CRITERIA AND WEIGHTAGE

Enrollment No	**1.** Quality of information/Knowledge presented in SEMINAR **10**	**2** Creativity, Innovation in SEMINAR presentation 10	**3**. Response to the question during seminar presentation 10	**4** Establishment of Innovative Problem Statement and its presentation 10	**5** Objectives of the project and action plan 10	

Sign: **Name: ----------** **(Course Expert/s)**	**Sign:** **Name: ----------** **(Program Head)** **(Information Technology)**

MSBTE Approval Dt. 24/02/2025

Programme Name/s	**: Automobile Engineering./ Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Civil & Environmental Engineering/ Mechanical Engineering/ Mechatronics/ Production Engineering/ Computer Science/ Electronics & Computer Engg.**
Programme Code	**: AE/ AI/ AN/ AO/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IE/ IF/ IH/ LE/ ME/ MK/ PG/ SE/ TE**
Semester	**: Fifth**
Course Title	**: INTERNSHIP(12 WEEKS)**
Course Code	**: 315004**

I. RATIONALE

Globalization has prompted organizations to encourage skilled and innovative workforce. Internships are educational and career development opportunities, providing practical/ hands-on experience in a field or discipline. Summer internship is an opportunity for students to get accustomed to modern industry practices, apply the knowledge and skills they've acquired in the classroom to real-world situations and become familiar with industry environments before they enter the professional world. Keeping this in mind, industrial training is incorporated to all diploma programmes as it enables the student to get equipped with practical skills, soft skills and life skills

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help the student to attain the following industry identified competency through various teaching learning experiences: Apply skills and practices to industrial processes.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Observe time/resource management and industrial safety aspects.
- CO2 - Acquire professional experience of industry environment .
- CO3 - Establish effective communication in working environment.
- CO4 - Prepare report of assigned activities and accomplishments.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315004	INTERNSHIP(12 WEEKS)	ITR	INP	-	-	-	-	36 - 40	10	-	-	-	-	-	100	40	100#	40	-	-	200

Legends: # External Assessment
Note: Credits for Industrial Training are in-line of guidelines of NCrF : The industrial training is of 12 weeks considering 36-40 hours per week engagement of students (as per Guidlines of GR of Maharashtra Govt.) under Self Learning with guidance of industry supervisor / Mentor

V General guidelines for organizing Industrial training

The Industry/organization selected for Industrial training/ internships shall be Government/Public Limited/ Private limited / Startup /Centre of Excellence/Skill Centers/Skill Parks etc.

1. Duration of Training - 12 weeks students engagement time
2. Period of Time slot - Between 4th and 5th semester (12 weeks) i.e. commencement of internships will be immediately following the 4th semester exams.
3. Industry area - Engineering Programme Allied industries of large, medium or small-scale, Organization/Govt./ Semi Govt Sectors.

VI Role(s) of Department at the Institute:

Following activities are expected to be performed by the concerned department at the Polytechnics.

Table of activities to be completed for Internship

S.No	Activity	Suggested Schedule WEEKS
1	Collection of information about industry available and ready for extending training with its offered capacity of students (**Sample Format 1**)	1st to 3rd week of 4th Semester
2	Allocations of Student and Mentor as per availability (Mentor: Student Ratio (1:15)	4th to 6th week of 4th semester
3	Communication with Industry and obtaining its confirmation Sample letter Format	6th to 8th week of 4th semester
4	Securing consent letter from parents/guardians of students (Sample Format 2)	Before 10th week of 4th semester
5	Enrollment of Students for industrial training (Format 3)	Before 12th week of 4rd semester
6	Issue of letter to industry for training along with details of students and mentor (Format 4)	Before 14th week of 4th Semester
7	Organize Internship Orientation session for students	Before end of 4th Semester
8	Progressive Assessment of industry training by Mentor	Each week during training period
9	Assessment of training by institutional mentor and Industry mentor	5th Semester ESE

Suggestions-

1. Department can take help of alumina or parents of students having contact in different industries for securing placement.
2. Students would normally be placed as per their choices, in case of more demand for a particular industry, students would be allocated considering their potentials. However preference for placement would be given to students who have arranged placement in company with the help of their parents or relatives.
3. Principal/HOD/Faculty should address students about industrial safety norms, rules and discipline to be maintained in the industry during training before relieving students for training.
4. The faculty members during the visit to industry or sometimes through online mode will check the progress of the student in the training, student attendance, discipline, and project report preparation each week.

VII Roles and Responsibilities of students:

1. Students may interact with the mentor to suggest choices for suitable industry, if any. If students have any contact in industry through their parents or relatives then the same may be utilized for securing placement for themselves and their peers.
2. Students have to fill the forms/formats duly signed by institutional authorities along with a training letter and submit it to a training officer/mentor in the industry on the first day of training.
3. Students must carry with him/her Identity card issued by the institute during the training period.
4. Students should follow industrial dressing protocols, if any. In absence of specific protocol students must wear college uniform compulsorily.
5. Students will have to get all necessary information from the training officer/mentor at industry regarding schedule of training, rules and regulation of the industry and safety norms to be followed. Students are expected to observe these rules, regulations and procedures.
6. Students must be fully aware that if they disobey any rule of industry or do not follow the discipline then non-disciplinary action will be taken .
7. Students must maintain a weekly diary (**Format 6**) by noting daily activities undertaken and get it duly signed from industry mentor or Industrial training in charge.
8. In case students face any major problems in industry such as an accident or any disciplinary issue then they should immediately report the same to the mentor at the institute.
9. Prepare a final report about the training for submitting to the department at the time of presentation and viva-voce and get it signed from a mentor as well as industry training in charge.
10. Students must submit the undertaking as provided in **Format 5**.

VIII Typographical guidelines for Industry Training report

Following is the suggestive format for preparing the training report. Actual report may differ slightly depending upon the nature of industry. The training report may contain the following

1. The training report shall be computer typed (English- British) and printed on A4 size paper.
2. Text Font -Times New Roman (TNR), Size-12 point

3. Subsection heading TNR- 12 point bold normal
4. Section heading TNR- 12 capital bold
5. Chapter Name/ Topic Name – TNR- 14 Capital
6. All text should be justified. (Settings in the Paragraph)
7. The report must be typed on one side only with double space with a margin 3.5 cm on the left, 2.5 cm on the top, and 1.25 cm on the right and at bottom.
8. The training report must be hardbound/ Spiralbound with a cover page in black color. The name of the candidate, diploma (department), year of submission, name of the institute shall be printed on the cover.
9. The training report, the title page should be given first then the Certificate followed by the acknowledgment and then contents with page numbers.

IX Suggestive format of industrial training report

Following format may be used for training report. Actual format may differ slightly depending upon the nature of Industry/ Organization.

- Title Page
- Certificate
- Abstract
- Acknowledgement
- Content Page

Chapter 1	Organization structure of Industry and general layout.
Chapter 2	Introduction to Industry / Organization (history, type of products and services, turn over and number of employees etc.)
Chapter 3	Types of Major Equipments/raw materials/ instruments/machines/ hardware/software used in industry with their specifications, approximate cost, specific use and routine maintenance done
Chapter 4	Processes/ Manufacturing Manufacturing techniques and methodologies and material handling procedures
Chapter 5	Testing of Hardware/Software/ Raw materials/ Major material handling product (lifts, cranes, slings, pulleys, jacks, conveyor belts etc.) and material handling procedures.
Chapter 6	Safety procedures followed and safety gears used by industry.
Chapter 7	Particulars of Practical Experiences in Industry/Organization if any in Production/Assembly/Testing/Maintenance
Chapter 8	Detailed report of the tasks undertaken (during the training).
Chapter 9	Special/challenging experiences encountered during training if any (may include students liking & disliking of workplaces).
Chapter 10	Conclusion
Chapter 11	References / sources of information

X Suggested learning strategies during training at Industry

- Students should visit the website of the industry where they are undergoing training to collect information about products, processes, capacity, number of employees, turnover etc.
- They should also refer to the handbook of the major machines and operations, testing, quality control and testing manuals.
- Students may also visit websites related to other industries wherein similar products are being manufactured.

XI Tentative week wise schedule of Industry Training

Industrial training is a common course to all Diploma programmes , therefore the industry selection will depend upon the nature of the programme and its related industry. The training activity may vary according to nature and size of industry.

The following table details of activities to be completed during industrial training.

Details of Activities to be completed during Industry training
Introduction of Industry and departments.
Study of Layout of Industry, Specifications of Machines , raw materials, components available in the industry
Study of setup and manufacturing processes
Execute given project or work assigned to the students, study of safety and maintenance procedures
Validation from industry mentor regarding project or work allocated
Report writing

XII CO-PO Mapping Table to be created by respective Department/faculty.

XIII. Formative Assessment of training : Suggested RUBRIC
(Note : Allot the marks in proportion of presentations and outcome observed. Marks excluding component of week 11 are to be filled by Institute mentor)

Week No	**Task to be assessed**	**Outcome Achievement - Poor**	**Outcome Achievement - Moderate**	**Outcome Achievement - High**		**Week-wise total Marks**
		Poor Marks	Average Marks	Good Marks	Excellent Marks	
1	Introduction of Industry	Minimal Knowledge of Departments, processes, products and work culture of the company **(Marks –1)**	Moderate Knowledge of Departments, processes, products and work culture of the company **(Marks –2)**	Good Knowledge of Departments, processes, products and work culture of the company **(Marks –3/4)**	Extensive Knowledge of Departments, processes, products and work culture of the company **(Marks –5)**	
2	Presentation of Layout of Industry, Specifications of Machines, raw materials, components available in the industry	Minimal w.r.t. tasks **(Marks –1)**	Moderate w.r.t. tasks **(Marks –2)**	Good w.r.t. tasks **(Marks –3/4)**	Extensive w.r.t. tasks **(Marks –5)**	
3	Participation in setup and manufacturing processes/platforms	Minimal Participation with poor understanding **(Marks –1-8)**	Moderate Participation with poor understanding **(Marks –9-12)**	Good Participation with poor understanding **(Marks –13-17)**	Extensive Participation with poor understanding **(Marks –18-20)**	

4 to 10	Execution of given project or work to the students, Follow of safety and maintenance procedures	Minimal Participation with poor understanding **(Marks –1-8)**	Moderate Participation with lower level understanding **(Marks – 9-12)**	Good Participation with Good understanding **(Marks – 13-17)**	Extensive Participation with excellent understanding **(Marks – 18-20)**	
11	Validation by industry mentor regarding project or work allocated	Minimal Participation with poor performance **(Marks –1-10)**	Moderate Participation with acceptable performance **(Marks – 11-15)**	Good Participation with Good performance **(Marks – 16-20)**	Extensive Participation with excellent performance **(Marks – 21-25)**	
12	Diary writing	• Results are not Presented properly, • Project work is summarized and concluded not acceptable • Future extensions are not specified **(Marks –1-10)**	• Results are Presented just casually • Project work is summarized and concluded casually • Future extensions are casually specified **(Marks –11-15)**	• Results are Presented well and properly, • Project work is summarized and concluded to a Good level • Future extensions are well specified **(Marks –16-20)**	• Results are Presented exhaustively • Project work is summarized and elaborated in excellent manner , concluded • Future extensions are excellently specified **(Marks –21-25)**	
Total Out of :100						

Marks for (FA) are to be awarded for each week considering the level of completeness of activity observed as per table specified in Sr.No. XIII above, from the daily diary maintained . Feedback from industry supervisor shall also be considered.

XIV Summative Assessment (SA) of training:

Academic year : 20 -20

i) Suggested RUBRIC for SA

Enrollment Number	**Observations from Orals**				**Presentations**				**Total (100)**
	Tasks undertaken (20)	Overall Understanding (20)	Creativity /Innovation demonstrated (10)	Knowledge acquired (10)	Speech Clarity (10)	Body Language (10)	Presentations (10)	Diary , Report writing and / Product (10)	

Name of mentor:
Signature of Mentor

XV FORMATS

Format-1: Collecting Information about Industry/Organization available for training along with capacity

1) Name of the industry/organization:
2) Address/communication details with email :
3) Contact person details:
   a) Name:
   b) Designation:
   c) Email
   d) Contact number/s:

4) Type:

Govt / PSU / Pvt /

Large scale / Medium scale / Small scale .....

5) Products/services offered by industry:

6) a) Whether willing to offer Industrial training facility during May/ June for Diploma in Engineering students: **Yes / No.**
   b) If yes, whether you offer 12 weeks training: **Yes/No**
   c) Possible Industrial Capacity:

Students	Programme name/ Title					Total
	Civil	Mechanical	Chemical			
Male						
Female						
Total						

7) Whether accommodation available for interns **Yes / No.**
If yes capacity:_____

8) Whether internship is charged or free:
If charged please specify amount per candidate: _____

Signature of responsible person at Industry:

Format-2: Obtaining Consent Letter from parents/guardians

(Undertaking from Parents)

To,

The Principal,
_____,

Subject: Consent for Industrial Training.
Sir/Madam,

I am fully aware that -
i) My ward studying in _____ semester at your _____ institute has to undergo 12 weeks of Industrial training for partial fulfillment towards completion of Diploma in _____ Engineering.
ii) For this fulfillment he/she has been deputed at_____ industry, located at _____ for Industrial training /internship for the period from _____ to _____ .
With respect to above I give my full consent for my ward to travel to and from the mentioned industry.
Further I undertake that –
a) My ward will undergo the training at his/her own cost and risk during training and/or stay.
b) My ward will be entirely under the discipline of the organization where he/she will be placed and will abide by the rules and regulations in face of the said organization.
c) My ward is NOT entitled to any leave during the training period.
d) My ward will regularly submit a prescribed weekly diary, duly filled and countersigned by the training supervisor of the organization to the mentor faculty of the polytechnic.

I have explained the contents of the letter to my ward, who has also promised to adhere strictly to the requirements. I assure that my ward will be properly instructed to take his own care to avoid any accidents/injuries in the industry. In case of any accident neither industry nor the institute will be held responsible.

Signature :
Name : _____
Address : _____

Phone Number :

Format-3: Students Enrollment for Industrial Training

(Academic Year –)

Sr No	Enrollment Number	Name of Student	Name of Industry	Name of Mentor at Institute

Format-4: Issue Letter to the Industry/Organization for the training along with details of students and mentors

To,

The HR Manager,

_____

Subject: Placement for Industrial training of ___ weeks in your organization....

Reference: Your consent letter no: ....

Sir,

With reference to the above we are honored to place the following students from this institute for Industrial training in your esteemed organization as per the arrangement arrived at.

The purpose of this training is to equip the student with some essential skills relevant to the demands of the industry and world of work, as well as to provide exposure to the professional environment and work culture. It is hoped that this training may enhance his/her employability and livelihood opportunities. In view of the above, we kindly request your support in facilitating this Industrial Training for the student. He/she has been adequately oriented and guided on the expectations of this training, including the maintenance of a daily diary during the training period. Additionally, the institute has secured the necessary consent and undertaking from the parent/guardian regarding the guidelines for exit training. In view of all the above industry shall refrain from involving students into the mundane and housekeeping activities. Your cooperation in this regard will be highly appreciated.

Diploma programme in _____ Engg.

Sr.No	Enrollment No	Name of Student	Name and designation of Mentor

Diploma programme in _____ Engg.

Sr.No	Enrollment No	Name of Student	Name and Designation of Mentor

Kindly extend all possible cooperation to the students for above.

Thanking you

Yours sincerely,

(Principal)
Name of the Institute:
with Seal

Cc- To HoD/Mentor

Format-5: Undertaking by the students

TO

Principal

Subject: Undertaking regarding Placement for Industrial training of 12/16/18 weeks duration

I .....Reg No:..... S/o/D/o. .....Studying in ---------- --------- at ----------Institute at ----------fully aware of the Industrial Training requirement and related responsibilities and participation in the ....., Industrial training between From: ..... To.....

I assure you that I will be of good behavior and be obedient to the staff and mentor during the ...../Industrial training. I will also abide and will not participate in all activity. I will also discipline myself within the rules and regulations of the Institution. I am also aware that I am participating in the ..... at my own risk and I will not hold the ----------Institute responsible in any way in any eventuality namely Accident /Injury/death or whatever mishap and I myself will be solely responsible for my safety.

Place :Signature of the student

Date :Reg. No.

Format-6: Internships Daily Diary

Name of the Student: _____ Name of the mentor (Faculty) : _____

Enrollment Number: _____ Semester: _____ Academic Year _____

Week	Day & Date	Discussion Topics/Activity	Details of Work Allotted Till Next Session /Corrections Suggested/Faculty Remarks	Signature of Industry Mentor
Week 01	Mon, Date			
	Tue, Date			
	Wed, Date			
	Thu, Date			
	Fri, Date			
	Sat, Date			
.	Mon, Date			
	Tue, Date			
.	Wed, Date			
	Thu, Date			
.	Fri, Date			
	Sat, Date			
Week n	Mon, Date			
	Tue, Date			
	Wed, Date			
	Thu, Date			
	Fri, Date			
	Sat, Date			

IOT APPLICATIONS **Course Code : 315341**

Programme Name/s	**: Digital Electronics/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electronics & Communication Engg./ Electronics Engineering/ Industrial Electronics/ Electronics & Computer Engg.**
Programme Code	**: DE/ EJ/ EK/ ET/ EX/ IE/ TE**
Semester	**: Fifth**
Course Title	**: IOT APPLICATIONS**
Course Code	**: 315341**

I. RATIONALE

The Internet of Things (IoT) explores the emerging concept of enabling objects to communicate with each other and with information systems. IoT lies in its ability to create a more connected, efficient, and innovative world by leveraging interconnected devices. The focus of IoT is to explore the capabilities of various technologies and employ creative thinking methods to develop innovative applications. This course will cover all the component IoT like sensor, microcontroller, cloud, communication protocol and it helps to prepare students to be acquainted with this technological transformation, with the ability to design, create and deploy advance smart IoT solutions.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to help students to attain the following industry/employer expected outcome through various teaching learning experiences:
" Maintain system based on Internet of Things (IoT)."

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Interpret the architecture of Internet of Things (IoT).
- CO2 - Select IoT system for given application development.
- CO3 - Integrate sensors and actuators in IoT based system.
- CO4 - Manage IoT communication for data handling.
- CO5 - Develop IoT based applications.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315341	IOT APPLICATIONS	IAU	DSE	4	-	2	-	6	2	3	30	70	100	40	25	10	25#	10	-	-	150

Total IKS Hrs for Sem. : 0 Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Describe the architecture of IoT system. TLO 1.2 List types of IoT system. TLO 1.3 Illustrate Physical and logical design of IoT system. TLO 1.4 Elaborate IoT enabling technology for the given application. TLO 1.5 List challenges in IoT based system.	**Unit - I Basics of Internet of Things (IoT)** 1.1 Basics of IoT: need, history, definition, characteristics, architecture of IoT with block diagram, IoT applications 1.2 Types of IoT system 1.3 Physical and logical design of IoT 1.4 Enabling technologies for IoT : Big Data Analytics, Cloud computing, Wireless Sensor Networks, Embedded Systems with example 1.5 IoT system challenges for design and security	Video Demonstrations Lecture Using Chalk-Board Presentations
2	TLO 2.1 Sketch architectural block diagram of NodeMCU. TLO 2.2 Describe the working of communication port of NodeMCU. TLO 2.3 Write procedure to use NodeMCU open-source IoT (Internet of Things) platform for given application. TLO 2.4 Write simple program to transfer data from NodeMCU (ESP 8266) to Arduino IDE.	**Unit - II Fundamental of NodeMcU** 2.1 NodeMCU ESP8266: features, specifications, hardware architecture, GPIO pins 2.2 NodeMCU communication port: UART, I2C,SPI 2.3 Terms used with NodeMCU: firmware, Wi-Fi, NodeMCU ESP8266 development board and its pin configuration 2.4 Arduino Integrated Development Environment - (IDE), Arduino IDE setup, creating, compiling and uploading programs from Arduino IDE to NodeMCU 2.5 Applications using NodeMCU ESP8266 and Arduino IDE. (Use of functions, string, array, timer, I/O function, PWM, interface LED & switch)	Lecture Using Chalk-Board Video Demonstrations Presentations Hands-on

IOT APPLICATIONS **Course Code : 315341**

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Select relevant sensor for the given application. TLO 3.2 Select relevant actuators for the given application. TLO 3.3 Describe the function of different input and outputs of the given sensors and actuators along with its technical specifications. TLO 3.4 Write program to interface sensors and actuators for given IoT application.	**Unit - III IoT Sensors and Actuators** 3.1 Linear and Digital input devices, Sensors: LDR, PIR, LM35, DHT11, IR, Gas sensor-MQ 4 3.2 Actuators: Linear and Rotary Actuators, servo motor and servo drive, solenoid valve, motorised actuators relay, stepper motor, IoT enabled actuators 3.3 Programming and Interfacing sensors and actuators with Node MCU: Interfacing Temperature sensor- LM-35, Gas sensor -MQ 4, Humidity sensor- DHT11, Photo sensors- LDR, PIR, IR with NodeMCU (only technical specifications, pin diagram and working expected)	Video Demonstrations Lecture Using Chalk-Board Presentations Hands-on
4	TLO 4.1 Describe the given IoT communication protocol with suitable example. TLO 4.2 Write steps to connect NodeMCU to Wi-Fi network. TLO 4.3 Write step by step procedure to create web Server with NodeMCU. TLO 4.4 Select IoT platform for the given application with suitable reason. TLO 4.5 Describe the procedure for data communication using MQTT protocol. TLO 4.6 Describe the given IoT network technology with suitable application.	**Unit - IV IoT Communication Protocol** 4.1 IoT Protocols: HTTP-REST, MQTT, CoAP, LoRa, NbIoT (features, methods, communication, applications) 4.2 IEEE802.11: Wi-Fi (features, applications), configure Wi-Fi on NodeMCU, Wi-Fi libraries, code for connecting to Wi-Fi networks 4.3 Procedure to create webserver with NodeMCU 4.4 Introduction to IoT cloud platforms: AWS IoT, ThingSpeak, Google Cloud IoT, Microsoft Azure IoT. (Use cases and features) 4.5 Data Communication using MQTT with NodeMCU: connect to a broker, publish and subscribe topics, collect, send and receive data using MQTT 4.6 IoT networking technology : LoRa, NbIoT (Features and applications)	Lecture Using Chalk-Board Presentations Video Demonstrations Hands-on Flipped Classroom
5	TLO 5.1 Explain the role of IoT in Industrial maintenance. TLO 5.2 Describe the integration of IoT in Agriculture. TLO 5.3 Illustrate IoT based smart city application with suitable sketch. TLO 5.4 Describe IoT based smart Energy meter with the help of block diagram. TLO 5.5 Describe IoT based surveillance system. TLO 5.6 Demonstrate IoT system for Smart home with the help of example. TLO 5.7 Explain the role of IoT in Electric vehicle for battery.	**Unit - V IoT Applications** 5.1 Industrial IoT (IIoT): predictive maintenance in manufacturing using IoT sensors to monitor equipment health and prevent failures 5.2 Agriculture: Green house control using IoT, Weather forecasting 5.3 Smart City: Street light control system, Traffic control System, Waste management 5.4 IoT based smart energy meter 5.5 IoT based surveillance system 5.6 Home automation: controlling lights, Fans and smart lock 5.7 EV(Electrical Vehicles) battery management using IoT (only basic working with conceptual block diagram)	Presentations Video Demonstrations Lecture Using Chalk-Board

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Establish a connection between the NodeMCU-ESP8266 and a computer using appropriate cables and drivers. LLO 1.2 Install and configure Arduino IDE for NodeMCU programming.	1	*Installation and configuration of Arduino IDE for NodeMCU	2	CO2
LLO 2.1 Interface LED and switch with NodeMCU to turn ON and OFF LED.	2	Interfacing LED and Switch with NodeMCU	2	CO2
LLO 3.1 Control relay operation using NodeMCU and IR sensor.	3	*Interfacing relay and IR sensor with NodeMCU	2	CO3
LLO 4.1 Measure and display humidity and temperature using DHT 11 and NodeMCU.	4	Interfacing Humidity sensor with NodeMCU	2	CO3
LLO 5.1 Motion detection using PIR sensor and NodeMCU.	5	Interfacing PIR Sensor with NodeMCU	2	CO3
LLO 6.1 Configure NodeMCU to connect to a Wi-Fi network and troubleshoot connectivity issue.	6	*Connecting NodeMCU to Wi-Fi network	2	CO4
LLO 7.1 Use HTTP protocol to send sensor data from NodeMCU to a web server (use any cloud service).	7	*Data Transmission from NodeMCU to Web Server.	2	CO4
LLO 8.1 Set up MQTT communication to publish and subscribe to topics using NodeMCU.	8	Implemention of MQTT Protocol with NodeMCU	2	CO4
LLO 9.1 Measure data from LDR to monitor light intensity and transmit it to cloud. LLO 9.2 Control intensity of LED according to the data received from cloud. (use any cloud service)	9	*Monitoring and controlling light intensity using NodeMCU	2	CO4
LLO 10.1 Design a smart home system using NodeMCU to Control the lights, Fans and Locking system. (use any cloud service)	10	*Implemention of IoT enabled Smart Home applications	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Interface a glucometer with Node MCU to measure glucose level and it to WebServer.
- Prepare a report of IoT based remote patient Monitoring system (case study).
- Develop IoT based Smart parking system for your institute using NodeMCU.
- Develop IoT Based IPL Scoreboard using NodeMCU to Display Live Score using Cricket API.

Assignment

- Describe the Use of IoT in Electrical Vehicles for Battery charging.
- Describe the architectural block diagram of ESP32 NodeMCU.
- Describe the Use of IoT in Drone Technology.

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Acuators-5v Relay, DC Motor	3,10
2	Sensors:LDR-Light dependent resistor, IR- Infrared sensor, PIR sensor, DHT11-Humidity and temperature sensor.	3,4,5,7,9,10
3	Any open source cloud service available (viz. ThingSpeak/ Google cloud / Microsoft Azure/AWS/ others).	7,9,10
4	IoT Trainer kit using NodeMCU with switches and LED's	All
5	Computers/Laptops: with operating system windows 10 or higher version.	All
6	Software tools- Arduino IDE (open Source)	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Basics of Internet of Things (IoT)	CO1	6	2	6	4	12
2	II	Fundamental of NodeMcU	CO2	8	4	4	6	14
3	III	IoT Sensors and Actuators	CO3	10	2	4	12	18
4	IV	IoT Communication Protocol	CO4	8	2	4	6	12
5	V	IoT Applications	CO5	8	2	4	8	14
Grand Total				**40**	**12**	**22**	**36**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two offline unit test of 30 marks and average of two-unit test will considered for out of 30 marks.

For formative assessment of laboratory learning 25 marks.
Each practical will be assessed considering 60% weightage to process, 40% weightage to product.

Summative Assessment (Assessment of Learning)

- End semester assessment of 70 marks.

End semester summative assessment of 25 marks for laboratory learning.

XI. SUGGESTED COS - POS MATRIX FORM

IOT APPLICATIONS **Course Code : 315341**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	1	-	1	1	2			
CO2	3	3	3	2	1	1	2			
CO3	3	3	3	2	2	2	3			
CO4	2	2	1	2	1	2	2			
CO5	3	3	3	2	2	2	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Arshdeep Bahga, Vijay Madisetti	Internet of Things: A Hands-On Approach	University Press, ISBN: 9788173719547
2	Raj Kamal	INTERNET OF THINGS Architecture and Design Principles	McGraw Hill Education (India) Private Limited, ISBN: 9789390727384
3	Adrin McEwen & Hakim Cassimality	Designing the Internet of things	Wiley India, ISBN: 9781118430620
4	David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Rob Barton, Jerome Henry	IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things	Cisco Press, ISBN: 9781587144561
5	Richard Blum	Sams Teach Yourself Arduino™ Programming in 24 Hours	Pearson Education, Inc. ISBN: 9780672337123
6	Sudip Misra, Anandarup Mukherjee, Arijit Roy	Introduction to IoT	Cambridge University Press, ISBN:9781108842952
7	Rahul Dubey	An Introduction to Internet of Things: Connecting Devices, Edge Gateway, and Cloud with Applications	Cengage India Private Limited, ISBN: 9789353500931931

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013000944973053952187 5_shared/overview	IoT Platform
2	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013294742104276992298 93_shared/overview	"Mastering IoT with Arduino". Infosys Spring board online course for Thinkspeak platform.
3	https://www.arduino.cc/en/software	Arduino IDE software
4	https://www.tinkercad.com/projects?subject=arduino&sort=views	Arduino projects on Tinkercad
5	Introduction to Internet of Things - Course (nptel.ac.in)	Complete coverage of IoT
6	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013843012953202688286 57_shared/overview	IoT Automation with ESP8266 with Projects
7	https://www.guru99.com/iot-tutorial.html	IoT Tutorial: Introduction to Internet of Things (IoT Basics)

IOT APPLICATIONS **Course Code : 315341**

Sr.No	Link / Portal	Description
8	https://infyspringboard.onwingspan.com/web/en/app/toc/lex_auth_013000944973053952187 5_shared/overview	IoT Platform

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

OPERATING SYSTEM USING LINUX **Course Code : 315353**

Programme Name/s : **Electronics & Computer Engg.**

Programme Code : **TE**

Semester : **Fifth**

Course Title : **OPERATING SYSTEM USING LINUX**

Course Code : **315353**

I. RATIONALE

The operating system manages memory, processes, hardware, and software of the computer, and also it is possible for the user to interact with the computer without acquainting the computer languages. This course helps students to enhance skills for using Operating System functions, Linux OS principles, Tools, Commands, and Shell Programming.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

The aim of this course is to attend following industry/employer excepted outcome through various teaching learning experiences:
Maintain Linux-Based Operating Systems to deliver high performance, security, flexibility, and cost-effectiveness.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Install linux Operating System and System tools to perform various functions of Operating System.
- CO2 - Apply concept of Process Management and Inter-Process Communication(IPC).
- CO3 - Apply scheduling algorithms to calculate turnaround time and average waiting time.
- CO4 - Use concept of different Memory Management Techniques.
- CO5 - Use File Management Techniques.

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme											
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315353	OPERATING SYSTEM USING LINUX	OSL	DSC	5	-	2	2	9	3	3	30	70	100	40	25	10	25#	10	25	10	175

Total IKS Hrs for Sem. : Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Explain functions of Linux OS. TLO 1.2 List types of Operating System. TLO 1.3 Execute Linux commands on command line for the given task. TLO 1.4 Enumerate system calls and describe functions of each.	**Unit - I Overview of Operating System** 1.1 Operating System: Concept, Components of Operating System, Operating System Structure (Simple Structure, Monolithic Structure, Layered Structure, Micro-Kernel Structure, Virtual Machines), Functions of Operating Systems, Services of OS 1.2 Different Types of Operating Systems: Serial Processing, Batch OS, Multiprogramming OS, Real-Time OS, Time-Sharing OS, Multiprocessor Systems, Distributed OS, Mobile OS-Android, Mac OS 1.3 Command Line Interface and Graphical User Interface: LINUX, WINDOWS, Comparison of LINUX and WINDOWS 1.4 System Call: Concept, Types of System call (for Process Management, File Management, Directory Management, Miscellaneous System Calls)	Lecture Using Chalk-Board Presentations Demonstration
2	TLO 2.1 Describe Process and Process State with suitable diagram. TLO 2.2 Describe functions of the given component of process stack in Process Control Block. TLO 2.3 Explain working of Inter-Process Communication(IPC) with suitable diagram. TLO 2.4 Explain characteristics of the given multithreading model.	**Unit - II Process Management** 2.1 Process: Process States, Process Control Block(PCB) 2.2 Process Scheduling- Scheduling Queues, Schedulers, Context Switch 2.3 Inter-Process Communication(IPC): Introduction, Shared Memory System and Message Passing System 2.4 Threads - Benefits, Users and Kernel Threads, Multithreading Models – One to One, Many to One, Many to Many	Lecture Using Chalk-Board Presentations Demonstration

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Discuss need for given job scheduling criteria. TLO 3.2 Calculate turnaround time and average waiting time of the given scheduling algorithm. TLO 3.3 Explain necessary conditions leading to Deadlock.	**Unit - III CPU Scheduling and Algorithms** 3.1 Scheduling Types, Scheduling Objectives, CPU and I/O burst cycles, Pre-emptive, Non Pre-emptive Scheduling, Scheduling Criteria 3.2 Types of Scheduling Algorithms - First Come First Serve(FCFS), Shortest Job First(SJF), Shortest Remaining Time(SRTN), Round Robin(RR), Priority Scheduling, Multilevel Queue Scheduling 3.3 Deadlock - System Models, Necessary conditions leading to Deadlocks, Deadlock Handling, Preventions, Avoidance, Recovery from deadlock banker's algorithm	Lecture Using Chalk-Board Presentations Demonstration
4	TLO 4.1 Describe working of Memory Management in Linux OS. TLO 4.2 Describe characteristics of Memory Management Techniques. TLO 4.3 Write algorithm for the given page replacement technique to calculate page fault for the given page reference string.	**Unit - IV Memory Management** 4.1 Basic Memory Management: Partitioning, Fixed and Variable, Free Space Management Techniques Bitmap, Linked List, Swapping 4.2 Virtual Memory: Introduction to Paging, Segmentation, Fragmentation and Page fault 4.3 Page Replacement Algorithms: FIFO, LRU, Optimal	Lecture Using Chalk-Board Presentations Demonstration
5	TLO 5.1 Explain structure of the given file system with example. TLO 5.2 Describe step by step procedure for the given file access method. TLO 5.3 Describe step by step file allocation method with diagram. TLO 5.4 Describe the process for managing files/directories and assign access permissions to the specified files/directories. TLO 5.5 Explain features of the given Raid level structure of hard disk.	**Unit - V File Management** 5.1 File: Concepts of file, types of files, File Attributes, File Operations, File System Structure, Linux File System 5.2 Access Methods: Sequential, Direct, Swapping 5.3 File Allocation Methods - Contiguous, Linked, Indexed, File protection 5.4 Directory Structure: Single level, Two levels, Tree-structured Directory 5.5 Disk Organization and Disk Structure: Physical structure, Logical structure, Raid structure of disk, Raid level 0 to 6	Lecture Using Chalk-Board Presentations Demonstration

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Install Linux (or alike) Operating System. LLO 1.2 Execute General Purpose Commands: date, time, cal, clear, banner/figlet, tty, script, man, who, whoami, passwd, pwd, echo, bc.	1	* 1) Installation of Linux (or alike) Operating Systems 2) Execution of general purpose commands in Linux	2	CO1
LLO 2.1 Execute Process related Commands: ps, wait, sleep, exit, kill, pr.	2	* Execution of process related commands	2	CO2
LLO 3.1 Execute file and directory manipulation commands: Is, rm, mv, cp, cat (file saving and redirection operator), touch, join, split.	3	* Execution of file and directory manipulation commands(part -1)	2	CO2

OPERATING SYSTEM USING LINUX **Course Code : 315353**

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Execute file and directory manipulation commands: mkdir, rmdir, cd, cmp, comm, diff, tar, zip, Use of wild card character (i.e. ?, *, []), chmod.	4	Execution of file and directory manipulation commands(part -2)	2	CO2
LLO 5.1 Execute text processing head, tail, sort, wc, grep, tac, nl, tr, cut, paste, spell, more.	5	Execution of filter commands in Linux	2	CO2
LLO 6.1 Develop a 'C' program to calculate turn around time and waiting time of any one given scheduling algorithm: FCFS, SJF, Priority, Round-Robin Algorithm.	6	* Write a 'C' program to calculate turn around time and waiting time of given scheduling algorithm	2	CO3
LLO 7.1 Execute memory manipulation commands: top, htop, free, df, du, vmstat.	7	* Execution of memory manipulation commands	2	CO4
LLO 8.1 Explore vi editor and execute all editor commands.	8	Use vi editor to create and edit files	2	CO5
LLO 9.1 Develop a Shell Script using Numeric Comparison, String Comparison, File Comparison for the given task.	9	Execution of Shell Script using comparison statement	2	CO5
LLO 10.1 Develop Shell Script using control statements and loops for a given task.	10	* Execution of Shell Script using control structure and loops	2	CO5

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- The microproject has to be Industry Application based, internet-based, workshop-based, laboratory-based or field based as suggested by Teacher.

1) Develop menu driven program to show the result of Linux Commands.
2) Develop Small Game based on Shell Script.
3) Develop Shell Script to circulate message among users.
4) Develop a Shell Script to perform file operations like create, delete directory, create, delete, copy, rename files.
5) Develop a Shell Script to Automate backups of important files and directories.

Assignment

- Complete an Assignment on any relevant topic given by the Teacher:

1) Prepare report depicting features of different types of Operating System, Batch OS, Multi-programmed OS, Time Shared, Multiprocessor OS, Real Time Systems, Mobile OS with Example.
2) Write a comparative statement to calculate page fault for given page reference string by using different Page Replacement Algorithms.
3) Prepare a report to calculate total waiting time and turn around time of n processes with different CPU scheduling algorithm.
4) Prepare a report about Linux operating systems and its flavors from starting to till date its features, uses etc.
5) Prepare a report on different types of operating system architecture. Example: Simple structure, Monolithic structure, Layered Structure, Microkernel
6) Prepare a report on Editors available in Linux i.e. Nano, Sed, gawk.

Other

- Join and Complete the course on Operating System/Linux OS/Shell Scripting on Infosys Springboard/MOOC Courses

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computer system with all necessary components like; motherboard, random access memory (RAM), read-only memory (ROM), internal hard disk drives, Mouse, Keyboard, and Open Source Operating System. (Linux or Alike)	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Overview of Operating System	CO1	12	4	4	8	16
2	II	Process Management	CO2	10	2	4	8	14
3	III	CPU Scheduling and Algorithms	CO3	12	2	4	10	16
4	IV	Memory Management	CO4	10	2	4	8	14
5	V	File Management	CO5	6	2	4	4	10
Grand Total				**50**	**12**	**20**	**38**	**70**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Two offline unit test of 30 marks and average of two-unit test will be considered for out of 30 marks. For formative assessment of laboratory learning 25 marks. Each practical will be assessed considering 60% weightage to process, 40% weightage to product.

Summative Assessment (Assessment of Learning)

- End semester assessment of 70 marks. End semester summative assessment of 25 marks for laboratory learning.

XI. SUGGESTED COS - POS MATRIX FORM

OPERATING SYSTEM USING LINUX **Course Code : 315353**

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	1	1	1	1	2	1			
CO2	2	1	2	2	1	3	1			
CO3	1	1	-	2	1	1	1			
CO4	2	2	1	3	2	1	2			
CO5	2	3	3	3	1	2	3			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Silberschatz, Galvin	Operating System Concepts	John Wiley and Sons, Ninth Edition, 2015, ISBN: 978-1119800361, Edition-10th
2	Godbole, Achyut S.	Operating System	Tata McGraw Hill Education, 2015, ISBN: 978-0070702035
3	Stallings ,William	Operating Systems: Internals and Design Principles	Pearson, ISBN: 978-0133805918
4	Dhamdhere, Dhanjay M	Operating System	McGraw Hill, 2015 ISBN: 978-0072957693
5	Dr. Rajendra Kawale	Operating System	Devraj Publications, Mumbai ISBN: 978-8193355114
6	Das, Sumitabha	Unix Concept and Programming	McGraw Hill education, 2015, ISBN: 9780070534759
7	Richard Blum	Linux command line and shell scripting	Wiley India ISBN Number 978-1118983843
8	Jon Emmons, Terry Ckark	Easy Linux Commands	SPD, ISBN 13:978-81-8404-329-7

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	https://www.geeksforgeeks.org/operating-systems/	Operating System
2	https://www.tutorialspoint.com/operating_system/index.htm	Operating System
3	https://www.mygreatlearning.com/academy/learn-for-free/courses/operating-system	Operating System
4	https://www.javatpoint.com/linux-file-contents	Linux Commands
5	https://www.shellscript.sh/	Shell Script

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students

Programme Name/s	**: Artificial Intelligence/ Artificial Intelligence and Machine Learning/ Automation and Robotics/ Cloud Computing and Big Data/ Civil Engineering/ Chemical Engineering/ Computer Technology/ Computer Engineering/ Civil & Rural Engineering/ Construction Technology/ Computer Science & Engineering/ Digital Electronics/ Data Sciences/ Electrical Engineering/ Electronics & Tele-communication Engg./ Electrical and Electronics Engineering/ Electrical Power System/ Electronics & Communication Engg./ Electronics Engineering/ Computer Hardware & Maintenance/ Industrial Electronics/ Information Technology/ Computer Science & Information Technology/ Civil & Environmental Engineering/ Computer Science/ Electronics & Computer Engg.**
Programme Code	**: AI/ AN/ AO/ BD/ CE/ CH/ CM/ CO/ CR/ CS/ CW/ DE/ DS/ EE/ EJ/ EK/ EP/ ET/ EX/ HA/ IE/ IF/ IH/ LE/ SE/ TE**
Semester	**: Fifth**
Course Title	**: ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS**
Course Code	**: 315002**

I. RATIONALE

Entrepreneurship and Startups are introduced in this curriculum to develop the entrepreneurial traits among the students before they enter into professional life. Exposing and interacting with entrepreneurship and startup eco-system, students will develop entrepreneurial mind set. The innovative thinking with risk-taking ability along with other traits will be inculcated in the students through micro-projects and training. This exposure will be instrumental in orienting the students in transforming them to become job generators after completion of Diploma in Engineering.

II. INDUSTRY / EMPLOYER EXPECTED OUTCOME

Develop project proposals for launching small scale enterprises and starts up.

III. COURSE LEVEL LEARNING OUTCOMES (COS)

Students will be able to achieve & demonstrate the following COs on completion of course based learning

- CO1 - Identify one's entrepreneurial traits.
- CO2 - Use information collected from stakeholder for establishing/setting up/founding starts up
- CO3 - Use support systems available for Starts up
- CO4 - Prepare project plans to manage the enterprise effectively

IV. TEACHING-LEARNING & ASSESSMENT SCHEME

Course Code	Course Title	Abbr	Course Category/s	Learning Scheme					Credits	Assessment Scheme												
				Actual Contact Hrs./Week			SLH	NLH		Paper Duration	Theory				Based on LL & TL				Based on SL		Total Marks
															Practical						
				CL	TL	LL					FA-TH	SA-TH	Total		FA-PR		SA-PR		SLA		
											Max	Max	Max	Min	Max	Min	Max	Min	Max	Min	
315002	ENTREPRENEURSHIP DEVELOPMENT AND STARTUPS	ENDS	AEC	1	-	2	-	3	1	-	-	-	-	-	50	20	25@	10	-	-	75

Total IKS Hrs for Sem. : Hrs
Abbreviations: CL- ClassRoom Learning , TL- Tutorial Learning, LL-Laboratory Learning, SLH-Self Learning Hours, NLH-Notional Learning Hours, FA - Formative Assessment, SA -Summative assessment, IKS - Indian Knowledge System, SLA - Self Learning Assessment
Legends: @ Internal Assessment, # External Assessment, *# On Line Examination , @$ Internal Online Examination
Note :

1. FA-TH represents average of two class tests of 30 marks each conducted during the semester.
2. If candidate is not securing minimum passing marks in FA-PR of any course then the candidate shall be declared as "Detained" in that semester.
3. If candidate is not securing minimum passing marks in SLA of any course then the candidate shall be declared as fail and will have to repeat and resubmit SLA work.
4. Notional Learning hours for the semester are (CL+LL+TL+SL)hrs.* 10 Weeks
5. 1 credit is equivalent to 30 Notional hrs.
6. * Self learning hours shall not be reflected in the Time Table.
7. * Self learning includes micro project / assignment / other activities.

V. THEORY LEARNING OUTCOMES AND ALIGNED COURSE CONTENT

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
1	TLO 1.1 Compare advantages and disadvantages of Entrepreneurship TLO 1.2 Identify entrepreneurial traits through self-analysis TLO 1.3 Compare risk associated with different type of enterprise	**Unit - I Introduction to Entrepreneurship Development** 1.1 Entrepreneurship as a career – charms, advantages, disadvantages , scope- local and global 1.2 Traits of successful entrepreneur: consistency, creativity, initiative, independent decision making, assertiveness, persuasion, persistence, information seeking, handling business communication, commitment to work contract, calculated risk taking, learning from failure 1.3 Types of enterprises and their features : manufacturing, service and trading	Presentations Lecture Using Chalk-Board
2	TLO 2.1 Explain Important factors essential for selection of product/service and selection of process TLO 2.2 Suggest suitable place for setting up the specified enterprise on the basis of given data/circumstances with justification. TLO 2.3 Suggest steps for the selection process of an enterprise for the specified product or service with justification. TLO 2.4 Plan a market study /survey for the specified enterprise	**Unit - II Startup Selection Process** 2.1 Product/Service selection: Process, core competence, product/service life cycle, new product/ service development process, mortality curve, creativity and innovation in product/ service modification / development 2.2 Process selection: Technology life cycle, forms and cost of transformation, factors affecting process selection, location for an industry, material handling. 2.3 Market study procedures: questionnaire design, sampling, market survey, data analysis 2.4 Getting information from concerned stakeholders such as Maharashtra Centre for Entrepreneurship Development[MCED], National Institute for Micro, Small and Medium Enterprises [NI-MSME], Prime Minister Employment Generation Program [PMEGP], Directorate of Industries[DI], Khadi Village Instries Commission[KVIC]	Presentations Lecture Using Chalk-Board

Sr.No	Theory Learning Outcomes (TLO's)aligned to CO's.	Learning content mapped with Theory Learning Outcomes (TLO's) and CO's.	Suggested Learning Pedagogies.
3	TLO 3.1 Explain categorization of MSME on the basis of turnover and investment TLO 3.2 Describe support system provided by central and state government agencies TLO 3.3 State various schemes of government agencies for promotion of entrepreneurship TLO 3.4 Describe help provided by the non governmental agencies for the specified product/service TLO 3.5 Compute breakeven point, ROI and ROS for the specified business enterprise, stating the assumptions made	**Unit - III Support System for Startup** 3.1 Categorization of MSME, ancillary industries 3.2 Support systems- government agencies: MCED, NI MSME, PMEGP,DI, KVIC 3.3 Support agencies for entrepreneurship guidance, training, registration, technical consultation, technology transfer and quality control, marketing and finance. 3.4 Breakeven point, return on investment (ROI) and return on sales (ROS).	Presentations Lecture Using Chalk-Board
4	TLO 4.1 Explain key elements for the given business plan with respect to their purpose/size TLO 4.2 Justify USP of the given product/ service from marketing point of view. TLO 4.3 Formulate business policy for the given product/service. TLO 4.4 Choose relevant negotiation techniques for the given product/ service with justification TLO 4.5 Identify risks that you may encounter for the given type of business/enterprise with justification. TLO 4.6 Describe role of the incubation centre and accelerators for the given product/service.	**Unit - IV Managing Enterprise** 4.1 Techno commercial Feasibility study, feasibility report preparation and evaluation criteria 4.2 Ownership, Capital, Budgeting, Matching entrepreneur with the project 4.3 Unique Selling Proposition [U.S.P.]: Identification, developing a marketing plan. 4.4 Preparing strategies of handling business: policy making, negotiation and bargaining techniques 4.5 Risk Management: Planning for calculated risk taking, initiation with low cost projects, integrated futuristic planning, definition of startup cycle, ecosystem , angel investors, venture capitalist 4.6 Incubation centers and accelerators : Role and procedure	Presentations Lecture Using Chalk-Board

VI. LABORATORY LEARNING OUTCOME AND ALIGNED PRACTICAL / TUTORIAL EXPERIENCES.

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 1.1 Collect information of successful entrepreneurial traits	1	*Preparation of report on entrepreneurship as	2	CO1
LLO 2.1 Identify different traits as an entrepreneur from various field LLO 2.2 Suggest different traits from identified problem	2	Case study on ‘Traits of Entrepreneur’	2	CO1
LLO 3.1 Explore probable risks for identified enterprise.	3	*Case study on ‘Risks associated with enterprise	2	CO1

Practical / Tutorial / Laboratory Learning Outcome (LLO)	Sr No	Laboratory Experiment / Practical Titles / Tutorial Titles	Number of hrs.	Relevant COs
LLO 4.1 Identify new product for development LLO 4.2 Prepare a newly developed product	4	*Preparation of report on 'Development of new Product	2	CO1 CO2
LLO 5.1 Identify Process for development of product for new startup	5	Preparation of Report on ' Process selection 'for new startup	2	CO1 CO2 CO3
LLO 6.1 Develop questioner for market survey	6	*Market survey for setting up new Start up	2	CO2 CO3
LLO 7.1 Interpret the use of Technology Life Cycle	7	A Case study on ' Technology life cycle' of any successful entrepreneur.	2	CO3
LLO 8.1 Use information related to support of startups from Government and non-government agencies' LLO 8.2 Prepare report for setting up startup	8	*Preparation of report on 'Information for setting up new startup' from MCED/MSME/KVIC etc	2	CO3 CO4
LLO 9.1 Compute ROI of successful enterprise.	9	Case study on 'Return on Investment (ROI)'of any successful startup	2	CO3
LLO 10.1 Calculate of ROS of any successful enterprise	10	Case study on 'Return on sales (ROS)'of any successful startup	2	CO3
LLO 11.1 Calculate Brake even point of any enterprise	11	Preparation of report on 'Brake even point calculation' of any enterprise.	2	CO3 CO4
LLO 12.1 Prepare feasibility report of given business	12	*Preparation of report on 'feasibility of any Techno-commercial business"	2	CO4
LLO 13.1 Plan a USP of any enterprise.	13	*A case study based on 'Unique selling Proposition (USP) of any successful enterprise	2	CO4
LLO 14.1 Prepare a project report using facilities of Atal Incubation center.	14	*Prepare project report for starting new startup using 'Atal incubation center (AIC)	2	CO1 CO2 CO3 CO4

Note : Out of above suggestive LLOs -

- '*' Marked Practicals (LLOs) Are mandatory.
- Minimum 80% of above list of lab experiment are to be performed.
- Judicial mix of LLOs are to be performed to achieve desired outcomes.

VII. SUGGESTED MICRO PROJECT / ASSIGNMENT/ ACTIVITIES FOR SPECIFIC LEARNING / SKILLS DEVELOPMENT (SELF LEARNING)

Micro project

- Prepare a 'Pitch- desk' for your start up
- Prepare a business plan for a. Market research b. Advertisement agency c. Placement Agency d. Repair and Maintenance agency e. Tour and Travel agency
- Prepare a 'Social entrepreneurship business plan, plan for CSR funding.
- Prepare a ' Women entrepreneurship business plan ' Choose relevant government scheme for the product/service
- Prepare a business plan for identified projects by using entrepreneurial eco system for the same (Schemes, incentives, incubators etc.)

Note :

- Above is just a suggestive list of microprojects and assignments; faculty must prepare their own bank of microprojects, assignments, and activities in a similar way.
- The faculty must allocate judicial mix of tasks, considering the weaknesses and / strengths of the student in acquiring the desired skills.
- If a microproject is assigned, it is expected to be completed as a group activity.
- SLA marks shall be awarded as per the continuous assessment record.
- For courses with no SLA component the list of suggestive microprojects / assignments/ activities are optional, faculty may encourage students to perform these tasks for enhanced learning experiences.
- If the course does not have associated SLA component, above suggestive listings is applicable to Tutorials and maybe considered for FA-PR evaluations.

VIII. LABORATORY EQUIPMENT / INSTRUMENTS / TOOLS / SOFTWARE REQUIRED

Sr.No	Equipment Name with Broad Specifications	Relevant LLO Number
1	Computers with internet and printer facility	All

IX. SUGGESTED WEIGHTAGE TO LEARNING EFFORTS & ASSESSMENT PURPOSE (Specification Table)

Sr.No	Unit	Unit Title	Aligned COs	Learning Hours	R-Level	U-Level	A-Level	Total Marks
1	I	Introduction to Entrepreneurship Development	CO1	4	0	0	0	0
2	II	Startup Selection Process	CO2	2	0	0	0	0
3	III	Support System for Startup	CO3	2	0	0	0	0
4	IV	Managing Enterprise	CO4	2	0	0	0	0
Grand Total				**10**	**0**	**0**	**0**	**0**

X. ASSESSMENT METHODOLOGIES/TOOLS

Formative assessment (Assessment for Learning)

- Assessment during practicals

Summative Assessment (Assessment of Learning)

- End of term examination

XI. SUGGESTED COS - POS MATRIX FORM

Course Outcomes (COs)	Programme Outcomes (POs)							Programme Specific Outcomes* (PSOs)		
	PO-1 Basic and Discipline Specific Knowledge	PO-2 Problem Analysis	PO-3 Design/ Development of Solutions	PO-4 Engineering Tools	PO-5 Engineering Practices for Society, Sustainability and Environment	PO-6 Project Management	PO-7 Life Long Learning	PSO-1	PSO-2	PSO-3
CO1	2	2	2	-	-	3	2			
CO2	2	2	2	2	-	3	2			
CO3	2	2	2	2	-	3	2			
CO4	2	2	2	2	-	3	2			

Legends :- High:03, Medium:02,Low:01, No Mapping: -
*PSOs are to be formulated at institute level

XII. SUGGESTED LEARNING MATERIALS / BOOKS

Sr.No	Author	Title	Publisher with ISBN Number
1	Dr. Nishith Dubey, Aditya Vyas , Annu Soman , Anupam Singh	Un- boxing Entrepreneurship your self help guide to setup a successful business	Indira Publishing House ISBN 2023,978-93-93577-70-2
2	Gujral, Raman	Reading Material of Entrepreneurship Awareness Camp	Entrepreneurship Development Institute of India (EDI), GOI, 2016 Ahmedabad
3	Chitale, A K	Product Design and Manufacturing	PHI Learning, New Delhi, 2014; ISBN: 9788120348738
4	Charantimath, Poornima	Entrepreneurship Development Small Business Entrepreneurship	Pearson Education India, New Delhi; ISBN: 9788131762264
5	Khanka, S.S.	Entrepreneurship and Small Business Management	S.Chand and Sons, New Delhi, ISBN: 978-93-5161-094-6

XIII . LEARNING WEBSITES & PORTALS

Sr.No	Link / Portal	Description
1	http://www.mced.nic.in/allproduct.aspx	MCED Product and Plan Details
2	http://niesbud.nic.in/Publication.html	The National Institute for Entrepreneurship and Small Business Development Publications
3	http://niesbud.nic.in/docs/1standardized.pdf	Courses : The National Institute for Entrepreneurship and Small Business Development
4	https://www.nabard.org/Tenders.aspx?cid=501andid=24	NABARD - Information Centre
5	http://www.startupindia.gov.in/pdffile.php?title=Startup%20India%20Action%20Planandtype=Actionandq=Action%20Plan.pdfandc ontent_type=Actionandsubmenupoint=action	Start Up India
6	http://www.ediindia.org/institute.html	About - Entrepreneurship Development Institute of India (EDII)
7	http://www.nstedb.com/training/training.htm	NSTEDB - Training

Note :

- Teachers are requested to check the creative common license status/financial implications of the suggested online educational resources before use by the students